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(54) Title: METHOD AND APPARATUS FOR CHECK CLEARING
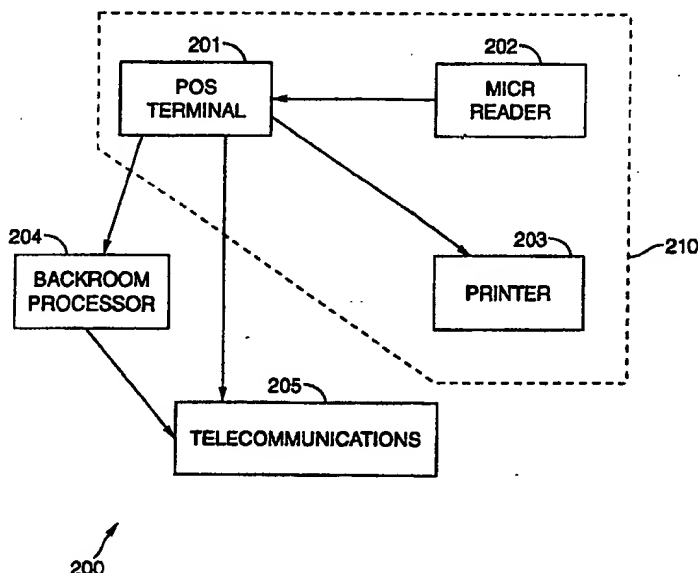
(57) Abstract

A method and structure are provided for processing checks (101) in a timely and cost-effective manner. A check recipient uses the system to gather data from checks received for prompt check processing. The hardware includes an MICR reader (202) for reading account information and means for associating MICR data with information pertaining to the transaction at hand. This information is combined in a data record which is stored for future batch data transmission to a clearinghouse or the issuing bank itself. In an alternative embodiment, the data is communicated in real time to the clearinghouse or issuing bank. In another embodiment, one or more selection criteria are used to determine which checks are high risk and processing these checks in real time, with the remaining checks being processed in the batch mode.

+ DESIGNATIONS OF "SU"

Any designation of "SU" has effect in the Russian Federation. It is not yet known whether any such designation has effect in other States of the former Soviet Union.

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METHOD AND APPARATUS FOR CHECK CLEARING

INTRODUCTION

Technical Field

This invention pertains to electronic data processing of financial instruments, and more specifically to a method and structure for clearing checks written by a customer.

Background

Figure 1 shows the typical path by which a check 101 finds its way to the issuing bank such that the checking account user's account is debited. As shown in Figure 1, the customer writes check 101 and presents it to merchant 102 as a convenient way for the customer to make a payment to merchant 102. The merchant will then, typically at the end of the day, provide the check (together with others received that day) to the merchant bank 103, as a deposit to the account which merchant 102 maintains in merchant bank 103. Merchant bank 103, after posting the checks to Merchant 102 account, forwards a batch of checks to the automated clearing house (ACH) 104, such as that provided by the National Automated Clearing House Association (NACHA) of Washington, D.C. ACH 104 sorts the checks by their issuing banks, electronically transmits information pertaining to the checks to Federal Reserve Bank 105, and forward the paper checks to the appropriate issuing banks. Federal Reserve Bank 105 in turn electronically transmits information to issuing bank 106 so that each check 101 is debited to the check writer's account maintained in issuing bank 106. Since the vast majority of checks clear without problems, checks are assumed to be valid. If, in the event there is a problem with the check, such as the account has been closed, or the account contains non-sufficient funds, issuing bank 106 has a certain period of time in which it must issue an

exception report indicating that the check has not
cleared. This information is communicated to Merchant
Bank 103 so that the check amount can be deducted from
the merchant's account in order to nullify the deposit
to the merchant's account made by Merchant Bank 103 when
it assumed that the check was valid.

Table 1 depicts the typical time delay and costs
associated with each check taking the prior art path
shown in Figure 1. While these costs and time delays do
not seem particularly large to the uninitiated, partly
due to the fact that most consumers are accustomed to
the time delays involving clearing checks, it is highly
advantageous to merchants and financial institutions to
speed the check clearing process and reduce the costs
associated therewith. Over 55 billion checks are
written annually, of which 10 to 15 billion are written
to merchants at the point of sale (POS). Thus, the cost
associated with processing these checks, as well as the
time delays involved in transferring funds (i.e., the
"float") result in a very large cost associated with
check processing. Magnetically encoded checking account
numbers are printed on checks in order to speed this
process, yet as shown in Table 1 the process remains
inherently slow and costly.

Table 1

	Appropriate Time Delay	Approximate Cost per check
Merchant to Merchant Bank	1-5 days	$.05-.10
Merchant Bank to ACH	1 day	.01-.02
ACH to Federal Reserve	1 day	.01
Federal Reserve to Issuing Bank	1 day	.01

It has been attempted to utilize debit cards in
place of checks and credit cards in order to allow
merchants to instantly debit a customer's account.

However, there are a number of disadvantages with debit card systems. First, debit card systems require processing in real time. Not only does this cause a time delay to both the consumer and the merchant, but the costs of maintaining communication links for real time processing are expensive, on the order of $0.15 per transaction. Furthermore, checking accounts and credit cards are already widely held, and there is some reluctance on the part of consumers to embrace debit cards. Merchants who accept debit cards, such as those gas stations which allow customers to pay using their automated teller machine (ATM) cards, find many consumers unwilling to utilize their ATM cards due to the additional expense (typically $0.15-0.25 per transaction) and perhaps the psychological reluctance to allow a merchant direct debit access to their bank account.

Furthermore, due to a lack of industry standards, for example pertaining to electronic networks, personal identification numbers (PINs), and encryption keys, inadequate customer incentives, and high costs, the use of debit cards has not become widely accepted.

Another disadvantage utilizing the present method for clearing checks is that the long time delay allows fraudulent check writers an excessive amount of time during which they are free to write fraudulent checks before their checking account numbers are added to a list of problem checking accounts.

SUMMARY OF THE INVENTION

In accordance with the teachings of this invention, a novel method and structure are provided for processing checks in an extremely timely and cost-effective manner. In accordance with the teachings of this invention, a ch ck r cipient, such as a merchant, utility billing department, and the like, utilize hardware and software for quickly gath ring data from checks r ceived in order to allow prompt processing of

those checks. Such hardware preferably includes a
reader for reading the MICR account information
printed on the check, and means for associating that
data with information pertaining to the transaction at
5   hand, including for example, the dollar amount of the
transaction. This information is combined in a data
record which is stored for future batch data trans-
mission to a clearing house or the issuing bank
itself. In an alternative embodiment, this data is
10   communicated in real time to the clearing house or
issuing bank. In yet another embodiment of this
invention, one or more selection criteria are used to
determine which checks will be processed in real time,
with the remaining checks being processed in the batch
15   mode. For example, checks written above a threshold
dollar amount, out of state checks, or any other high
risk checks are processed in real time in order to
minimize losses due to fraudulent check use.

20   BRIEF DESCRIPTION OF THE DRAWINGS
                Figure 1 depicts the typical prior art
process by which a check is written and ultimately
returned to the issuing bank; and
                Figure 2 is a block diagram depicting one
25   embodiment of a transaction system constructed in
accordance with the teachings of this invention.

                DETAILED DESCRIPTION
                Figure 2 depicts one embodiment of a system
30   for use by a merchant in accordance with the teachings
of this invention. Merchant system 200 includes one
or more point of sale systems 210 including, for
example, point of sale terminal 201 such as a typical
electronic cash register, or the like. Magnetic Ink
35   Character Recognition (MICR) reader 202 is used for
reading the magnetic account number printed on checks,
which data is fed to POS terminal 201. Alternatively,
th information pertaining to the check's account

number, etc. can be ntered in any convenient manner,
for xample via the keypad on the POS terminal 201, or
via a customer identification card issu d by the
merchant. However, the use of the MICR reader allows
greatest through put and accuracy.   Printer 203 is
used by POS terminal 201 for a variety of tasks, if
desired, for example, printing a sales slip, printing
validation information on a check, or printing a check
receipt, as will be described in more detail later.
POS terminal 201 is connected to backroom processor
204, such as those which are known in the prior art
for maintaining sales information, performing price
lookups, and inventory adjustment during the course of
business. Telecommunications unit 205 is connected to
backroom processor 204 and, if desired, directly to
POS terminal 201 to allow data to be communicated to a
check clearing house, for example.

The operation of the system of Figure 2, in one
embodiment, is as follows. The merchant utilizes POS
terminal 201 to enter a transaction. POS terminal 201
can be, for example, a typical prior art electronic
cash register, or a more sophisticated computer
system. Alternatively, POS terminal 201 may be an
accounts receivable system utilized by a public
utility, for example, rather than the typical cash
register found at a merchant.

The customer then tenders payment. Payments
tendered utilizing credit cards, cash, or debit cards
may be processed in a conventional manner. When the
customer provides a check, however, the check is read
by MICR reader 202 and the account information is
provided to POS terminal 201. POS terminal 201 then
provides additional information in order to create a
data record for this transaction which is being paid
for by check. Appropriate fields for this data record
are, for xample, as follows:

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Date and Time

Merchant demand deposit account (DDA) number
(checking account number)

Customer checking account No. and Routing
information

Amount of check

Check No.

Any other discretionary data (electronic
journaling)

Certain of this information can be provided
automatically by POS terminal 201. Other information,
such as amount the check is written for is provided
by the merchant, for example via the POS keypad.
Electronic journaling information is additional
information which may either be retained by the
merchant or used to provide a more precise indication
of the nature of the purchase on the customer's
monthly checking account statement. Such additional
information may include, for example, the name of the
merchant, the merchant's location, a summary of the
goods for services provided, for example sorted by
department in the department store. This electronic
journaling information serves, for example, to reward
the customer when reviewing his monthly statement that
the charges appearing on the monthly statement are in
fact correct. The merchant can use such additional
information for other purposes, for example, to
maintain some indication of a customer's buying
preferences.

If desired, the data record is then used to
verify check authorization, for example, by being
compared to a positive file (which lists all allowable
checking account numbers), or more likely against a
negative file such as provided by SCAN of Seattle,
Washington, Telecheck of Denver, Colorado or Tele-
credit of Florida, which provide information regarding
known troublesome ch cking accounts. If such author-

ization is not provided, the transaction can, if
desired, be canc lled by the merchant, thereby mini-
mizing losses due to bad checks, as is well known.

5   Once authorization is provided (if the author-
ization step is performed), next the check is placed
in printer 203 and validation information is printed
on the check, if desired. Such validation information
serves as an indication that electronic data pertain-
ing to this check has been routed for collection, and
10   that the check may thus be considered "cancelled."
Such validation information includes, for example,
information similar to a rubber endorsement stamp
typically used by merchants who process checks in
accordance with prior art techniques. Such informa-
15   tion typically includes the merchant's name and the
merchant's DDA number. The validation information
prints in accordance with the teachings of this
invention can also quite easily include the date and
time of the transaction and language indicating that
20   the check has been cancelled and is being cleared
through to the customer's checking account elec-
tronically. Alternatively, other means can be used to
provide validation information on the check, for
example, a rubber stamp used for this purpose. While
25   this is less desirable than using a printer, in
certain circumstances it may obviate the need for
additional printer, and a simple rubber stamp, or the
like, can serve as a convenient backup in the event of
printer failure. However, in a preferred embodiment,
30   printer 203 is used for purposes in addition to pro-
viding validation information on a customer's check,
for example, to assist in preparing credit card slips
and the like.

           The validated check is then returned to the
35   customer for safekeeping, thus avoiding the need for
the check to be physically transported through the
system depicted in Figure 1 for ultimate return to the
customer. Alt rnatively, the check is retained by the

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merchant. This has the advantage of allowing the
merchant to retain possession of the check in the
event that there is a problem with its collection. In
either event, whether the check is returned to the
5   customer or retained by the merchant, a receipt is, if
desired, printed and given to the customer indicating
that payment has been made by check, and the check is
being electronically cleared. This receipt can be
either a part of or separate from another receipt
10   indicating detailed information regarding the
transaction just completed.

The data record thus created by POS terminal 201
can be added to a data file maintained by POS terminal
201 for batch uploading to backroom processor 204, for
15   example, on a periodic basis or at the end of a shift.
Alternatively, POS terminal 201 sends the data record
to backroom processor 204 immediately, or as soon as
backroom processor 204 is able to receive it. In this
event, POS terminal 201 need only have sufficient
20   storage capacity to serve as a buffer when there are
delays in the ability of backroom processor 204 to
receive data.

Periodically, backroom processor 204 will take
the data records it has accumulated and upload them to
25   a clearing house. Backroom processor 204 may first
process the information, if desired. Various types of
processing are possible, such as removing that data
pertaining to checks written on the one or more banks
with which a merchant does its own banking as well as
30   those bank affiliate banks. This data is then
uploaded to the appropriate bank directly, without the
need of traveling through the clearing house system.
Other types of backroom processing may be performed
prior to transmitting check data to the clearing house
35   or directly to one or more banks. For example, checks
written over a threshold dollar amount, out-of-state
checks, or other checks thought to be high risk based
upon other criteria can be selected in order to

prioritize data to be uploaded to the ACH or directly
to a bank.

If d sired, priority uploads may be performed
either by backroom processor 204 or POS terminal 201
which, in one embodiment, is directly linked to
telecommunications unit 205. Such priority uploads
may serve a number of functions. For example, small
batches of records may be uploaded relatively fre-
quently by backroom processor 204 either directly to a
bank or to the clearing house. Such priority uploads
may include, for example, those which are greater than
a pre-determined dollar amount. In one embodiment,
priority uploads are performed by POS terminal 201 in
a real time basis, for example, when the check amount
exceeds a predetermined dollar amount, when the check
is an out-of-state check, or any other criteria which
may be programmed or selected by the merchant "on the
fly" which may lead the merchant to view a particular
check with some suspicion. In this event, the trans-
action is delayed pending the real time upload,
thereby reducing losses due to bad checks.

Following the upload by backroom processor 204 to
one or more banks and clearing houses, an exception
report is printed by backroom processor 204 indicating
problem checks contained within the uploaded data
file, for example, checks written on closed accounts,
or accounts having non-sufficient funds. This
exception report is prepared from information
received from the issuing bank, and is either sent
electronically or by printed media either directly to
the merchant or to the merchant via the Merchant
Bank, the Federal Reserve Bank, and/or an automated
clearing house. In one embodiment, backroom
processor 204 will again upload for clearing those
checks which have not clear d. If desired, a
predetermined delay can be used prior to uploading
this data again, in order to allow the customer to
r pl nish his ch cking account before the s cond and

subs quent tries. Alternatively, other criteria can
be established by the merchant for determining how to
handle such problem checks noted in the exception
report. For example, the time delay, if any, before
uploading for clearing such problem checks which have
not cleared, can be selected based upon a
predetermined set of criteria. Such criteria can
include, for example, the time of day the check was
written, the date the check was written, the day of
the week the check was written, whether the check was
written on an out-of-state bank account, or any other
criteria selected by the merchant. For example, the
merchant may determine that, statistically, different
categories of checks should be handled differently in
order to maximize the collection of such checks.

Thus, in accordance with the teachings of this
invention, a check has essentially become the equiva-
lent of an electronic debit card, but with significant
advantages. The vast majority of consumers already
have checking accounts, as compared with a smaller
number have electronic debit cards. Therefore, the
use of checks as debit cards in accordance with the
teachings of this invention avoids the need for
distributing or maintaining a separate debit card,
with their associated costs. Furthermore, most
consumers feel fairly comfortable with utilizing
checks as a method of payment, far more comfortable
than the use of electronic debit cards. The savings
which will accrue to even a small merchant due to
reduced bank paper handling fees, reduced losses due
to bad checks, and more rapid availability of funds
from checks will easily pay for the installation of
hardware and software for use in accordance with the
teachings of this invention.

In one mbodiment to this invention, a primary
record is used of, for example, 94 bytes as specified
by the National Automated Clearinghouse Association
(NACHA) 1990 ACH rules, specifically Appendix I

entitled "ACH File Exchange Specifications". The
"1990 ACH Rules" and the "1990 NACHA Operating Rules,
Corporate Edition" are published by the National
Automated Clearinghouse Association of Herndon,
Virginia and are hereby incorporated by reference.

When such a primary record alone is used, the
customer's monthly checking account statement will
indicate for each check the date, check no., and
amount without specific merchant information.
Alternatively, each primary record is used with one
or more appended records, for example each of an
additional 94 bytes, to provide information such as
the merchant's name and location and, if desired, more
specific information such as the type of goods or
services purchased, the quantity, and/or the exact
name of the goods or services purchased can be
included in such appended records for each purchase.

Due to the relatively small percentage of
disputed checks, a preferred embodiment provides that
the merchant electronically store all sales receipt
line items, and provide to the clearing house a pri-
mary record only. In the case of disputed charges,
the clearing house will request further information
from the merchant, and the merchant transmits addi-
tional information to the clearing house as appended
records to allow the clearing house to address the
disputed charges. This minimizes the amount of
information being transmitted, but allows full docu-
mentation to be transmitted in the event a particular
check is disputed.

There are advantages in utilizing the teachings
of this invention to the consumer, the merchant, and
the banking system. The consumer advantages are that
their time spent at a point of sale is reduced, as
checks can b processed more quickly. Savings asso-
ciat d with bank processing of a customer's checking
account may be passed on to the consumer.

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The merchant benefits from a number of advantages
in accordance with the teachings of this invention.
Merchants can receive a quicker deposit and thus
faster access to funds from checks received from
customers. Deposit fees will likely be less, since
the merchant is providing electronic data, rather
than a paper check. Additional deposit fees can be
saved if the merchant provides encoding on each check,
such as MICR encoding, indicating the amount of the
check. Since this encoding of the check amount saves
the merchant bank processing time, merchant banks
typically charge the merchant approximately 10 cents
per check deposited if the merchant encodes the amount
on each check, as compared with approximately 15
cents per check deposited which are not so encoded by
the merchant. Depositing is much easier as a merchant
need not fill out paper deposit slips, including
various information pertaining to each check, as well
as a total, and need not physically transport a batch
of checks with their deposit slips to a bank. Checks
which do not clear, for example because they are drawn
on an account which is closed or an account with non-
sufficient funds, are detected much quicker, thereby
allowing a greater likelihood of collecting on
returned checks as it is well known that collectibil-
ity decreases rapidly with age. A merchant having
multiple stores benefits in that a central location
may be used for consolidating check data, thereby
providing the benefit that a merchant's check pro-
cessing facilities can be consolidated, if desired,
and allow check processing to be accomplished in a
timely manner without delays associated with physi-
cally transporting paper checks to the central
location prior to electronically processing those
checks. The merchants are also afforded a greater
flexibility on check deposits and bank relationships
in that, because paper checks need not be physically
transported to the merchant's bank, the merchant can

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s lect a bank solely on the basis of business con-
sideration rather than the banks geographical proxi-
mity to the merchant.

The advantages to the banks are decreased pro-
5   cessing costs, decreased float, and an ability to
achieve their desired automated transaction plans
which have not been achieved to date in large part due
to the failure in the debit card programs. Further-
more, the banks are able to compete on a national
10   basis with greater ease since the need not be
geographically close to their customers for the
purposes of depositing checks. Also, the banks are
capable of eliminating handling of the physical check
and its ultimate return to the consumer. This saves a
15   great deal of physical infrastructure, as well as
costs. Furthermore, the banks are able to receive the
benefits of a debit card system without the need to
educate consumers and without the attendant costs
involved in the issuance of separate debit cards.
20   Other benefits are available as well. For
example, in one embodiment of this invention,
notification to a number of parties who are interested
in learning of problem checks is made automatically,
routinely, and in a cost effective and timely manner.
25   For example, when the issuing bank does not honor a
check, the issuing bank issues an exception report.
If desired, this exception report can be used by
either the issuing bank, the Federal Reserve Bank, the
Automated Clearing House, the merchant's bank, or the
30   merchant itself in order to notify other interested
parties. Such other interested parties include the
merchant's bank which must deduct the amount of the
check which has not be honored by the issuing bank,
the merchant, the merchant's collection agency, check
35   authorization services, and check verification
services. By promptly notifying each of these
parties, collections can be speeded, and problem
ch cks can be minimized. Furthermore, by notifying

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ach of these parties automatically, notification
costs are decreased.

Accordingly, the teachings of this invention
provide a novel method and structure for handling
checks having significant advantages over the prior
art check clearing system. In accordance with the
teachings of this invention, check are utilized much
as are debit cards, but without the attendant dis-
advantages experienced in debit cards which have thus
far lead to their poor acceptance.

The invention now being fully described, it will
be apparent to one of ordinary skill in the art that
many changes and modifications can be made thereto
without departing from the spirit or scope of the
appended claims.

All publications and patent applications
mentioned in this specification are herein incor-
porated by reference to the same extent as if each
individual publication or patent application was
specifically and individually indicated to be
incorporated by reference.

15

WHAT IS CLAIMED IS:

1.   A method for processing a check written on
an account provided by a financial institution com-
prising the steps of:
     receiving from a customer a check as a method of
payment;
     creating an electronic data record containing
information pertaining to said check;
     electronically transmitting said data record to
said financial institution to obtain payment of said
check by said financial institution.

2.   A method as in claim 1 wherein said
electronic data record comprises transaction
information provided by an electronic device and
information from said check.

3.   A method as in claim 2 wherein at least some
of said information from said check is detected by a
MICR reader.

4.   A method as in claim 2 wherein said elec-
tronic device comprises a POS terminal or a computer
system controlling the transaction information for
which payment is being made by said check.

5.   A method as in claim 1 wherein said elec-
tronic record is transmitted to said bank in a batch
with electronic records pertaining to other checks.

6.   A method as in claim 1 wherein said step of
transmitting said electronic record to said bank com-
prises the steps of:
     det rmining if said el ctronic record meets a
test indicating said electronic record should be
transmitted to said bank in real time;

if said test is met, transmitting said electronic record to said bank in real time; and

if said test is not met, adding said electronic record to a file including other electronic records pertaining to other checks, and transmitting said file to said bank in a batch mode.

7. A method as in claim 6 wherein said test indicating said electronic record should be transmitted to said bank in real time serves to detect one or more of the following conditions: the amount of the check is greater than a threshold amount, the check is an out-of-state check, the check has not been preapproved by a check verification or check guarantee service, and the check is deemed to be of high risk.

8. A method as in claim 1 which further comprises the step of, after creating said electronic data record, imprinting information on the check indicating that the check has been cancelled and sent for collection by electronic data transfer.

9. A method as in claim 8 which further comprises the step of, after said step of printing, returning said check to the customer.

10. A method as in the claim 8 which further comprises the step of, after said step of printing, causing said merchant to retain said check.

11. A method as in claim 1 which further comprises the step of, after receiving said check from said customer, seeking check verification from a ch ck verification servic or a check guarante service and, if said verification is not obtained, terminating said transaction.

12.   A method as in claim 1 which further comprises the step of, after receiving said check from said customer, seeking check verification from a check verification service or a check guarantee service and, if said verification is not obtained, allowing the merchant discretion as to whether to abort said transaction.

13.   A method as in claim 10 wherein, when the check is retained by the merchant, a receipt for the check is issued to the customer.

14.   A method as in claim 13 wherein said receipt for the check comprises a portion of the standard sales receipt issued by the merchant.

15.   A method as in claim 13 wherein said check receipt comprises a receipt separate from the normal sales receipt issued to the customer by the merchant.

16.   A method as in claim 1 which further comprises the step of creating one or more additional electronic data records associated with said electronic data record for storing discretionary information regarding the sales transaction.

17.   A method as in claim 16 which further comprises the step of electronically transmitting one or more of said additional data records with said data record to said financial institution.

18.   A method as in claim 16 wherein said one or more additional data records are retained by the merchant in the event they are needed to verify a disputed transaction.

19.   A method as in claim 18 wherein said one or more of said additional data records are electroni-

cally transmitted to said bank in the event of a
disputed charge.

20. A method as in claim 1 which further
comprises the steps of:
    receiving an exception report if said check has
not been honored by said financial institution; and
    again electronically transmitting said data
record to said financial institution to obtain payment
of said check by said financial institution.

21. A method as in claim 20 wherein said step of
again electronically transmitting said data record to
said financial institution is performed after a
predetermined period of time.

22. A method as in claim 20 wherein said step of
again electronically transmitting said data record to
said financial institution is performed in accordance
with a set of one or more parameters of said check.

23. A method as in claim 22 wherein said one or
more parameters are selected from the group of para-
meters consisting of: time the check was written,
date the check was written, amount of the check,
location of said financial institution, and other
criteria for believing said check to be high risk.

24. A method as in claim 1 which further
comprises the steps of:
    issuing an exception report if said check has
not been honored by said financial institution; and
    automatically notifying one or more of said
merchant, said merchant's bank, a check verification
service, a check authorization service, and a
collection firm.

CHECK

101

MERCHANT

102

BANK

103 MERCHANT BANK

104 ACH

105 FEDERAL RESERVE

BANK

106 ISSUING BANK

FIGURE 1

SUBSTITUTE SHEET

2/2
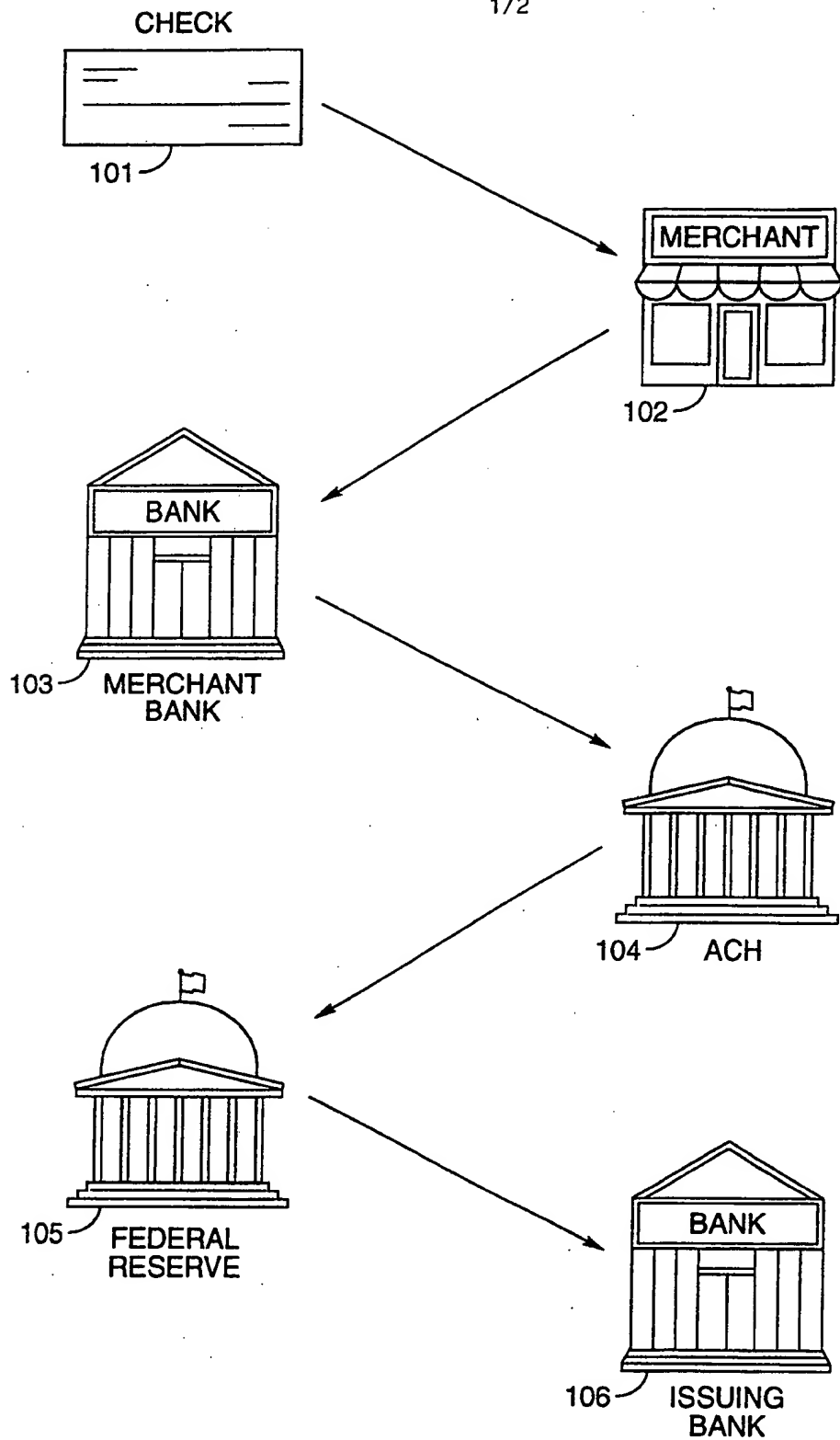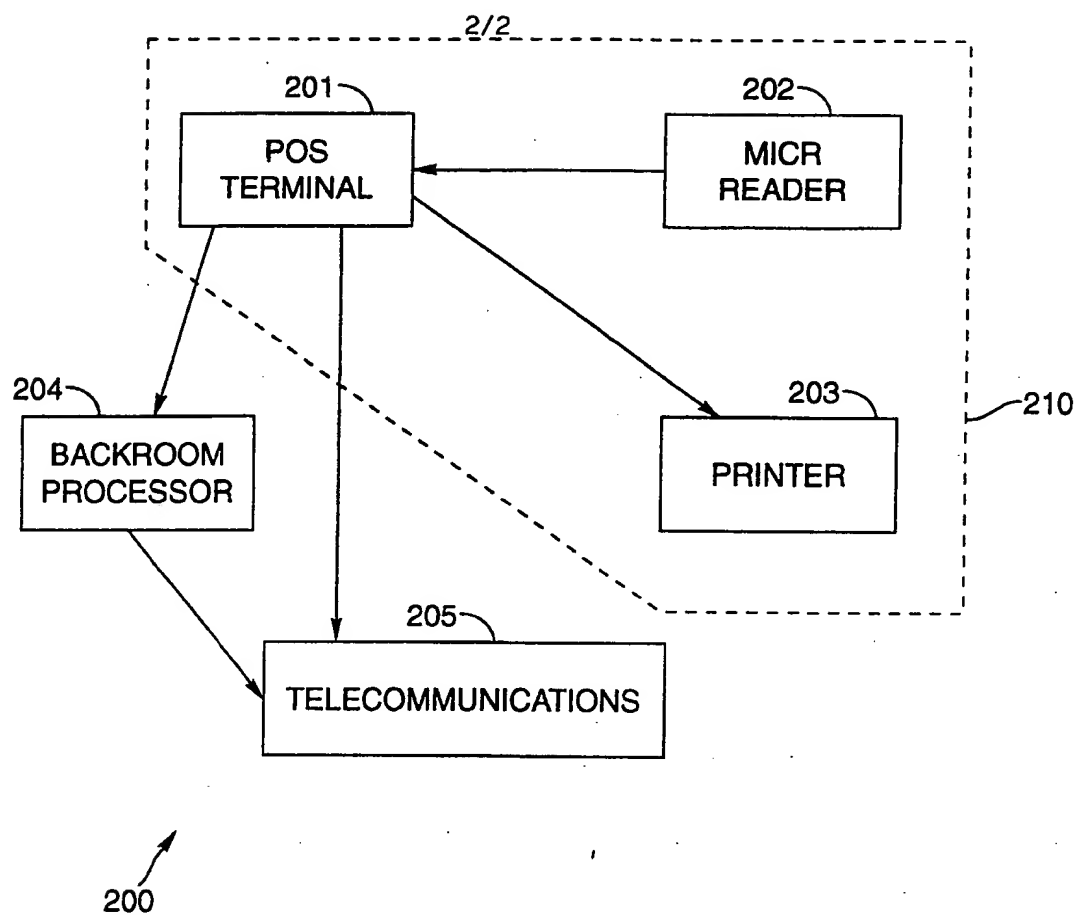
FIGURE 2

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US91/09038

I. CLASSIFICATION F SUBJECT MATTER (if several classification symbols apply, indicate all) 6
According to International Patent Classification (IPC) or to both National Classification and IPC
IPC (5): H04M 11/00; G06F 15/30

II. FIELDS SEARCHED

Minimum Documentation Searched 7	
Classification System	Classification Symbols
U.S.Cl.	235/379-383 364/401,406,408

Documentation Searched other than Minimum Documentation   to the Extent that such Documents are Included in the Fields Searched 8

III. DOCUMENTS CONSIDERED TO BE RELEVANT 9

Category *	Citation of Document, 11 with indication, where appropriate, of the relevant passages 12	Relevant to Claim No 13
X,P Y,P	US, A, 5,053,607 (CARLSON ET AL.) 07 October 1991 See column 3, line 35 - column 4, line 3.	1-4 5-10 and 18-23
Y	US, A, 4,972,463 (DANIELSON ET AL.) 20 November 1990 See Figure 3.	11-15, 24
A	US, A, 4,187,498 (CREEKMORE) 05 February 1980 See the entire document.	1-24
A	US, A, 4,436,992 (SIMJIAN) 13 March 1984 See Figure 3.	1-24
A	US, A, 4,454,414 (BENTON) 12 June 1984 See Figures 3-5.	1-24
A	US, A, 4,977,595 (OHTA ET AL.) 11 December 1990 See Background of the Invention.	1-24

* Special categories of cited documents: 10

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATI N

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
17 February 1992	08 APR 1992
International Searching Authority	Signature of Authorized Officer
ISA/US	Gail O. Hayes

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